## REMARKS

This paper is being presented in response to the non-final official action dated April 14, 2004, wherein: (**a**) claims 1-9, 12-14, and 17-18 have been rejected under 35 U.S.C. § 102(b) as being anticipated by Hasche U.S. Patent No. 2,845,335 (the "Hasche patent"); (**b**) claims 10, 11, and 16 have been rejected under 35 U.S.C. § 103(a) as being obvious over the Hasche U.S. Patent No. 2,845,335; (**c**) claim 15 has been rejected under 35 U.S.C. § 103(a) as being obvious over the Hasche patent in view of Brophy et al. U.S. Patent No. 4,767,569 (the "Brophy patent"); and, (**d**) the specification and drawings have been objected to due to informalities. Reconsideration and withdrawal of the rejections and objections are respectfully requested in view of the foregoing amendments and following remarks.

This paper is timely filed as it is accompanied by a petition for a one-month extension of time pursuant to 37 C.F.R. § 1.136(a) and payment of the requisite fee pursuant to 37 C.F.R. § 1.17(a).

### I. Brief Summary of the Amendments

#### A. Amendments to the Specification

Certain paragraphs of the application have been amended. Specifically, in response to paragraph 2 of the office action, the paragraph beginning at page 1, line 2, has been amended to indicate that U.S. patent application Serial No. 09/201,511 is now abandoned. In response to paragraph 4 of the office action, the paragraph beginning at page 15, line 21, has been amended to include an additional reference to the insulating material 24 that is also present in the vessel 102.

#### B. Amendments to the Drawings

In Figure 1, there is shown a lead line without a corresponding reference number. This lead line simply identifies the opposing side of tube 12. See the specification at page 11, line 18. Figure 1 has been amended to label the lead line with the number "12" in response to paragraph 5 of the office action. Submitted herewith is a paper entitled "Request for Approval of Drawing Changes," which includes a marked-up copy of Figure 1. In view of the foregoing, it is respectfully submitted that the drawings are in compliance with 37 C.F.R. § 1.83(a), and the objection to the drawing has been rendered moot.

#### C. Amendments to the Claims

Claim 1 has been amended to specify that the heated zone is a "heated reaction zone." Support for the amendment can be found in the specification at, for example, page 8, lines 25-29, wherein it is stated that a reactant mixture is combusted in the heated zone to generate combustion products.

Claim 1 has also been amended to recite the step of "heating the reactant mixture in the heated reaction zone from a temperature less than the superadiabatic combustion temperature to a temperature sufficient to result in a superadiabatic combustion." Support for the amendment can be found in the specification at, for example, page 8, lines 21-25, wherein it is stated that "the method includes the step of flowing the reactant mixture through a heated zone (*e.g.*, porous fixed bed) of a reactor...." Furthermore, it is also stated that "the porous, fixed bed ... serves as an intermediate for heat accumulation and regeneration ... sufficient to result in a SAC of the reactant mixture."

Innocuous amendments have been made to claims 4-6 and 8 to improve readability and to correct a claim dependency.

Claim 16 has been amended to replace "porous material" with "fixed bed" as suggested by the examiner.

No new matter has been added by the foregoing amendments as each is supported by the original disclosure.

## II. The 35 U.S.C. § 102(b) Rejection is Traversed

Claims 1-9, 12-14, and 17-18 have been rejected under 35 U.S.C. § 102(b) as being anticipated by the Hasche patent. *See* pp. 3-5 of the action. It is respectfully submitted that the pending claims are not anticipated by the Hasche patent and, therefore, reconsideration and withdrawal of the rejection are respectfully requested.

Claim 1 has been amended to specify that the "heated zone" of the reactor is a "heated reaction zone." Furthermore, claim 1 requires that an inlet reactant mixture be heated to a temperature sufficient for superadiabatic combustion in substantially the same location where the combustion and reformation reactions take place - the "heated reaction zone."

The Hasche patent does not disclose all of the limitations of claim 1. The reaction process disclosed in the Hasche patent includes three primary steps: mixing of reactants, heating of reactants, and combustion/reformation of reactants. The Hasche patent discloses a process whereby (a) air and fuel are initially preheated in a segregated fashion externally from the reactor's porous fixed bed, (b) the heated air and fuel are then mixed in a mixing chamber, and finally (c) the reactant mixture is fed to the porous fixed bed to carry out the reaction. *See* the Hasche patent at col 4, lines 37-50 and Figs. 1 and 6. The method recited in amended claim 1 is distinguishable because an inlet reactant mixture is first premixed upstream of the reactor. Once the reactant mixture enters the reactor, claim 1 requires that the heating step be performed on the well-mixed reactants in the same location where the reaction takes place (*i.e.* the porous fixed bed). The Hasche patent *only* describes the preheating of reactants *prior* to their entry into the porous fixed bed, and thus does not

disclose all of the limitations recited in claim 1. Consequently, the Hasche patent does not anticipate amended claim 1 or any claim dependent therefrom. *Verdegaal Bros. v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987) ("A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference."). Reconsideration and withdrawal of the rejection are respectfully requested.

Furthermore, the Hasche patent alone is not sufficient to establish a *prima facie* case of obviousness under 35 U.S.C. § 103(a) because there is no suggestion or motivation, either in the Hasche patent or in the knowledge generally available to one of ordinary skill in the art, to modify the reference. According to amended claim 1, the heating and reaction of reactants take place in the same volume, one that is packed with bed-packing material. It would be impractical to modify the Hasche reactor by replacing the entire interior volume with reactor bed-packing material, because there must still be a region devoid of packing along the length of the reactor in order to accommodate the burners of Hasche. *See* the Hasche patent at col 11, lines 71-73, and Figs. 1 and 6. The Hasche burners are intrusive and provide *in situ* heating of the reactants upon reactor start-up, in contrast to the method recited in amended claim 1, which can utilize external heating means, thus, permitting the entire reactor volume to be filled with packing material.

A person having ordinary skill in the art would not be motivated to practice superadiabatic combustion in a reactor with significant volumes devoid of packing material. Because superadiabatic combustion is a heterogeneous process, the lack of reactive surface area in a hot-void volume can result in inefficient reactor performance based on the over-consumption of fuel by the homogeneous combustion mechanism. Such over-consumption necessarily results in the under-production of desired hydrogen and hydrocarbon products by the heterogeneous reformation mechanism and does not, therefore, create a reasonable expectation of success for such a modification.

Moreover, the Hasche patent specifically teaches away from a process wherein the reactants are mixed prior to heating as recited in amended claim 1, preferring, instead, a process wherein segregated reactants are heated *prior* to mixing. Specifically, the Hasche patent acknowledges that "the hydrocarbon material and the oxygen-containing gas [may be] premixed [prior to heating] and two regenerative masses [may be] utilized rather than the four regenerative masses of the present invention." *See* the Hasche patent at col 6, lines 7-10. However, the Hasche patent instructs that the segregated preheating of reactants is "more suitable for both catalytic and non-catalytic reforming to produce gases with high hydrogen content, utilizing higher air-hydrocarbon ratios." *See id.* at col 6, lines 16-19. Thus, the Hasche patent teaches a fundamentally different procedure from that which is recited in amended claim 1 and claims dependent therefrom.

## III. The 35 U.S.C. § 103(a) Rejection is Traversed

Claims 10, 11, and 16 have been rejected under 35 U.S.C. § 103(a) as being obvious over the Hasche patent. Claim 15 has been rejected under § 103(a) as being obvious over the Hasche patent in view of Brophy et al. U.S. Patent No. 4,767,569 (the "Brophy patent"). *See* pp. 5-7 of the action.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the teachings of a plurality of references. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all of the claim limitations. The teaching or suggestion to make the claimed invention and the reasonable expectation of success must both be found in the prior art, and not based on the applicants' own disclosure. *In re Vaeck*, 20 USPQ2d 1438 (Fed. Cir. 1991); *see also* M.P.E.P. § 2143 (8th ed. (Rev. 2) May 2004).

The Hasche patent **does not** teach or suggest all of the limitations recited in claims 10, 11, and 16. As set forth in Section II, above, claim 1 has been amended to recite that the "heated zone" of the reactor is a "heated reaction zone" as well as to require that an inlet reactant mixture be heated to a temperature sufficient for superadiabatic combustion in substantially the same location where the combustion and reformation reactions take place. Because there is no motivation or suggestion to extend the teachings of the Hasche patent to encompass these aspects of the amended claim 1 (for the same reason as set forth above), whether or not the pressure ranges of claims 10 and 11 and catalyst concentrations of claim 16 are operating parameters within the ambit of knowledge for one skilled in the art is irrelevant. Thus, no *prima facie* case of obviousness has been made in the instant action, and none exits based on the applied publication. Accordingly, reconsideration and withdrawal of the § 103(a) rejection of claims 10, 11, and 16 are respectfully requested.

The combined disclosures of the Hasche and Brophy patents **do not** teach or suggest all of the limitations recited in claim 15. As noted above, claim 1 has been amended to recite that the "heated zone" of the reactor is a "heated reaction zone" as well as to require that an inlet reactant mixture be heated to a temperature sufficient for superadiabatic combustion in substantially the same location where the combustion and reformation reactions take place. Because there is no motivation or suggestion to extend the teachings of the Hasche patent to encompass these aspects of the amended claim 1 (for the same reason as set forth above), whether or not the pellet size range of claim 15 is obtainable via the combination of the Hasche and Brophy patents is irrelevant. Thus, no *prima facie* case of obviousness has been made in the instant action, and none exits based on the combination of

the applied publications. Accordingly, reconsideration and withdrawal of the § 103(a) rejection of claim 15 are respectfully requested.

## IV. Objections to the Specification

The specification has been objected to for failing to include the current status of referenced U.S. patent application Serial No. 09/201,511. The specification has been amended to address this deficiency. *See* Section I.A, above. Reconsideration and withdrawal of the objection to the specification are respectfully requested.

## V. Objections to the Drawings

As set forth above (see Section I.B., above), drawing Figure 1 has been amended to include a label for the lead line without a corresponding reference number.

In response to paragraph 3 of the action, it is noted that element number "20" is identified in the description on page 12, line 23, as "inlet 20." No corrections or amendments are therefore made in response to this objection.

The objection set forth in paragraph 4 of the action has been addressed by an amendment to the specification. *See* Section I.A, above. In view of the amendments, it is respectfully submitted that the drawings comply with 37 C.F.R. § 1.83(a), and an indication to that effect is respectfully solicited.

## VI. Objections to the Information Disclosure Statement

The pages included relating to the reference "Kennedy *et al.*, 10$^{th}$ Intern. Symp. on Transport Phenomena, Kyoto, Japan, Nov. 30 - Dec. 3, 1997, 451-55" represent the reference as it appears in the symposium proceedings. However, the copy of the reference supplied with the Information Disclosure Statement was provided by the authors of the reference, and was not copied from a bound volume of the proceedings. Accordingly, pages 2-5 as labeled in the provided reference correspond to pages 452-455 as they would appear in the symposium proceedings.

## CONCLUSION

In view of the foregoing, the applicants respectfully request entry of the amendments to the specification and Figure 1, entry of the amendments to claims 1, 4-6, 8, and 16, and reconsideration and withdrawal of the objections and rejections.

Should the examiner wish to discuss the foregoing, or any matter of form or procedure in an effort to advance this application to allowance, she is urged to contact the undersigned attorney.

Respectfully submitted,

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August 10, 2004

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